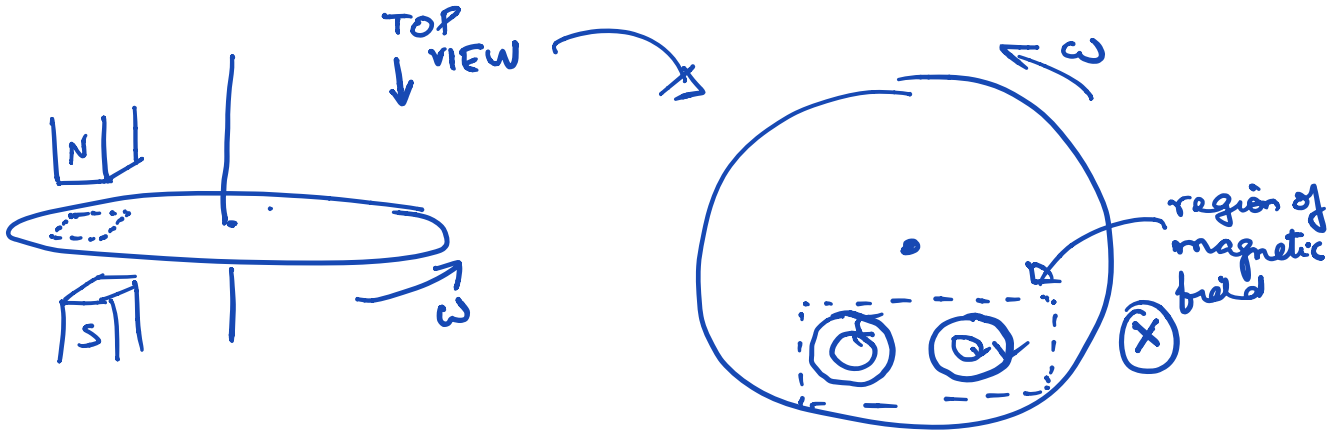
01.02.2019

ELL 301

Eddy Currents

(→ video of magnetic braking pendulum)



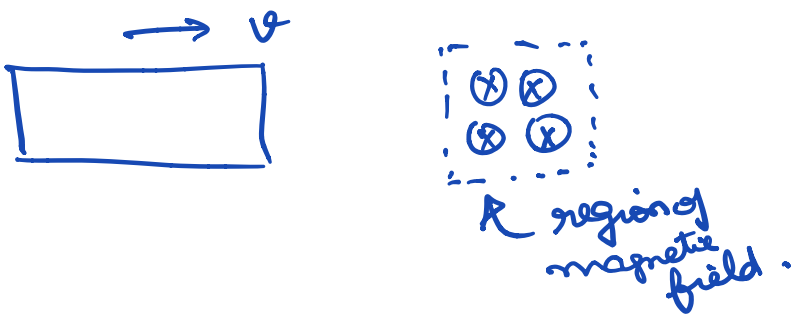
1. Direction of eddy currents?
2. Attraction / repulsion forces faced by disc?
3. Dependence of damping force on ω?

→ Changing magnetic field due to moving conductor, rotating at angular velocity ω.

⇒ induced emf $\sim -\frac{d(\text{flux})}{dt} \sim \omega$

↑ origin of the damping-like $\dot{\theta}$ term.

Linear version of eddy current brake



Wattmeters

Instrument to measure power.

How to measure power?

→ voltage × current

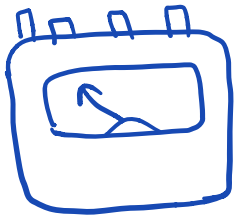
in ac case, average power = $VI\cos\phi$

Need to measure

- voltage, current, phase shift (ac)

Different cases

- ac vs dc
- analog vs digital
  - electrodynamometer → sample the waveforms of v, i, multiply, take average



$$\frac{V}{R}\sin\omega t \times I\sin(\omega t+\phi)$$

$$J\ddot{\theta} + b\dot{\theta} + k\theta =$$

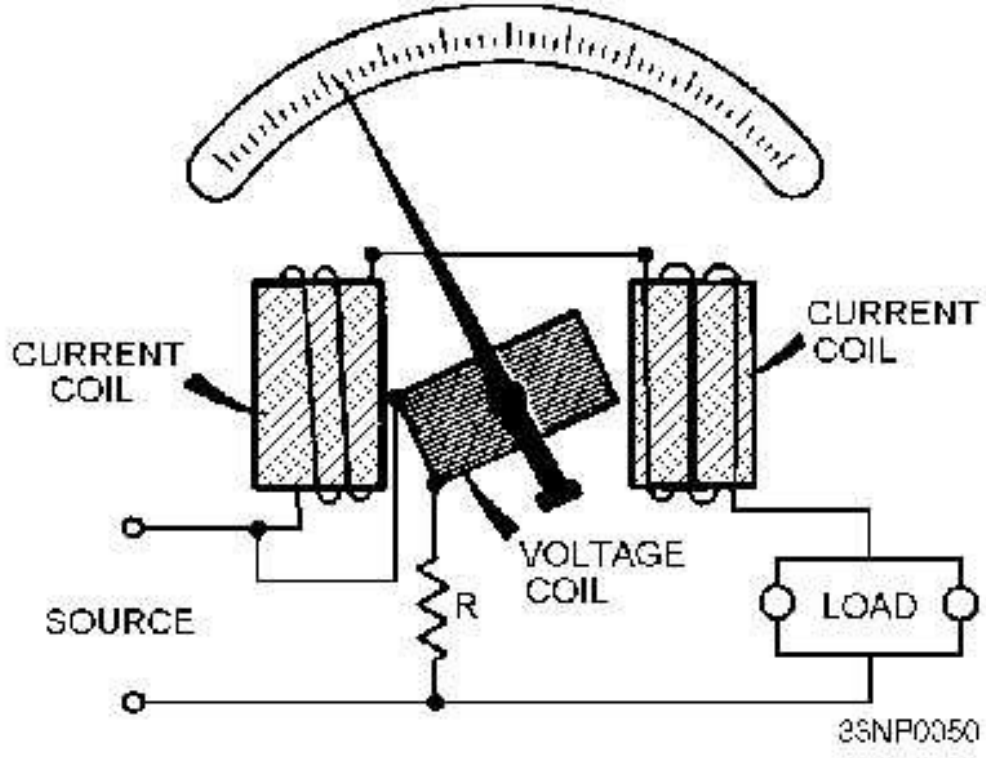
break $\sin\omega t \sin(\omega t+\phi)$ into sum of cos's

→ $\cos\phi - \cos(2\omega t+\phi)$

Measuring Instruments

Wattmeter is an electrodynamometer type instrument to measure electric power in a circuit.

A pointer is attached to the movable coil and the deflection is proportional to the repulsive force generated from the currents moving through the two coils.



Courtesy Prof. S. Janardhanan